

Posterior Reconstruction Before Anastomosis Improves the Anastomosis Time During Robot-Assisted Radical Prostatectomy

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ABSTRACT

Background and Objectives: Our goal was to evaluate posterior reconstruction of the rhabdosphincter during robot-assisted radical prostatectomy and determine whether this technique decreased anastomotic time of a surgeon in training to perform vesicourethral reconstruction.

Methods: We reviewed the first 25 robot-assisted prostatectomies performed by 2 urology surgeons in training (surgeon 1 and surgeon 2). The patient populations were matched for age, Gleason score, clinical stage, and PSA. Whereas surgeon 1 performed the vesicourethral anastomosis without posterior reconstruction, surgeon 2 reapproximated Denonvilliers' fascia of the posterior bladder to the rhabdosphincter. Time for each surgeon to complete the anastomosis and clinical factors was compared.

Results: Surgeon 1 had a median anastomosis time of 25 minutes (range, 17 to 48), whereas surgeon 2 had a median anastomosis time of 15 minutes (range, 10 to 30) ($P < 0.001$). Biopsy Gleason score, pathological tumor stage, perineural invasion, median age at the time of surgery, PSA, prostate weight, and estimated blood loss were not significantly different between surgeons ($P > 0.05$). Pathological Gleason score ($P = 0.045$) and total console time (surgeon 1 = 216 minutes, surgeon 2 = 176 minutes; $P = 0.002$) were significantly different between surgeons.

Conclusion: Posterior reconstruction prior to anastomosis decreases anastomosis time for robotic surgeons in training.

Key Words: Robotics, Prostatectomy, Prostatic neoplasms, Anastomosis, Surgical.

INTRODUCTION

Robot-assisted radical prostatectomy (RARP) is one treatment option for clinically localized prostate cancer. Several studies¹⁻⁴ suggest the robotic approach may offer significant benefits in clinical outcomes, as well as a decrease in the number of major and minor complications. This decrease in complications with the implementation of RARP has continued to improve as more cases are performed.⁵ The popularity of RARP has led to a large number of robotic surgeon trainees.⁶ These trainees range from residents to surgeons well versed in laparoscopy, open surgery, or both.

Previous studies⁷ in the literature have addressed robotic surgical training and suggest that trainees were able to adopt the skills of their mentor; thus, the presence of trainees did not affect the institutional learning ability. The learning curve is well documented in terms of surgical margin rates, but the addition of specific techniques, such as posterior reconstruction, and their effect on overall operative time regarding the urethral anastomosis remains poorly studied.^{8,9}

The use of RARP may decrease the incidence of urethrovesical anastomotic urinary leaks.¹⁰ This is potentially due to the quality of the anastomosis in that multiple sutures can be placed to achieve a tension free, mucosa-to-mucosa, water-tight anastomosis. Together with the magnification of structures, the ability to place the suture needle at optimal angles, and the decrease in tension on the vesicourethral anastomosis with reconstruction of the rhabdosphincter, an improved anastomosis is seen.¹¹ Furthermore, posterior reconstruction of the rhabdosphincter has been found to improve time to continence for patients undergoing RARP.^{12,13} The goal of our study was to evaluate the role of posterior reconstruction on the time of vesicourethral anastomosis by comparing the anastomotic times of the first 25 cases performed by 2 surgeons in training.

MATERIALS AND METHODS

After obtaining institutional review board approval, we performed a retrospective review of 50 patients who underwent RARP at our institution between 2007 and 2008.

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The patients were divided into 2 groups based on 2 surgeons in training who performed the RARP. Surgeon 1 performed the vesicourethral anastomosis without posterior reconstruction. Surgeon 2 performed posterior reconstruction prior to vesicourethral anastomosis. Both surgeons in training were supervised by faculty surgeons. These chief residents had similar laparoscopic and robotic experience during their residency training. All patients had clinically localized prostate cancer, and no patients were excluded from the study.

The vesicourethral anastomosis was performed by both surgeons in a standard fashion using a double armed 3-0 poliglecaprone suture on either a UR-16 or RB-1 needle. The anastomotic suture was run circumferentially from the 6 o'clock position posteriorly to the 12 o'clock position on the anterior urethra. A fresh 20 Fr Foley catheter was passed across the anastomosis prior to tying the sutures together. The catheter was then irrigated with 120mL to 180mL of normal saline to evaluate for anastomotic leakage.

The posterior reconstruction utilized by surgeon 2 consisted of a single 3-0 polyglactin suture on an SH needle, reapproximating the cut edge of Denonvilliers' fascia on the posterior bladder to the rhabdosphincter posterior to the urethra. All patients had a postoperative cystogram within 7 days to 10 days postoperatively.

Total console time and time to complete the vesicourethral anastomosis were recorded during each surgery. Additional factors analyzed included age at surgery, diagnostic PSA, biopsy Gleason score, pathological tumor stage, pathological Gleason score, perineural invasion, prostate weight, and estimated blood loss (EBL). Univariate analysis was performed and stratified by surgeon. Categorical variables underwent chi-squared analysis, and continuous variables were analyzed with the Mann-Whitney test. Age at surgery, PSA, pathological tumor stage, pathological Gleason score, perineural invasion, and prostate weight underwent binary logistic regression analysis stratified by surgeon in order to evaluate disease risk between the 2 groups. All statistics were performed using SPSS v.17.0 (Chicago, IL).

RESULTS

All 50 patients (25 from each surgeon) were included in the final analysis. Median anastomotic time for surgeon 1 was 25 minutes (range, 17 to 48) and for surgeon 2 was 15 minutes (range, 10 to 30). The difference in anastomotic time between the 2 surgeons reached statistical signifi-

cance ($P < 0.001$) (**Table 1**). Median total console time for surgeon 1 was 216 minutes (range, 153 to 332) and for surgeon 2 was 176 minutes (range, 116 to 301). The difference in median total console time between surgeons was also statistically significant ($P = 0.002$). Review of a subset analysis of postoperative cystogram data showed no leakage or extravasation in all available patients.

Preoperative variables including age at surgery, PSA, biopsy Gleason sum, and pathological variables including pathological tumor stage, pathological Gleason sum, perineural invasion, and prostate weight were not statistically different between the 2 surgeons. On multivariate analysis, the number of patients with a final pathologic Gleason sum of 7 performed by surgeon 2 was significantly greater than those operated on by surgeon 1 ($P = 0.033$) (**Table 2**).

DISCUSSION

Our study evaluated the role of posterior reconstruction on urethral anastomosis time during RARP. Surgeon 2, using the posterior reconstruction technique, was able to perform the anastomosis 40% faster than surgeon 1 ($P < 0.001$). This finding was independent of all pre- and postoperative variables with the exception of pathological Gleason sum and console time. Our theory is that performing posterior reconstruction prior to anastomosis may decrease technical difficulty by stabilizing the tissues, relieving early tension, and facilitating achievement of a water-tight, mucosa-to-mucosa anastomosis. Because this study was performed with surgeons in training, we also postulate that the reconstruction technique decreased the anastomotic time and likely resulted in better continence rates.

A study by Nguyen et al¹⁴ also found that posterior reconstruction of Denonvilliers' fascia during RARP significantly shortened the operative time, decreased time to continence at 3-day and 6-week intervals, and decreased the urethral shortening that occurs compared with when posterior construction is not used. They suggest that the return to continence following posterior reconstruction may be from increasing functional urethral length. The advantage of the posterior reconstruction is a shorter time period needed to perform the technique. The combination of decreased anastomosis time, as well as the improvement in anastomotic time for surgeons in training associated with our findings, suggests that posterior reconstruction is a valuable technique for the robotic surgeon in training.

Table 1. Univariate Analysis of Cohort Characteristics Stratified by Surgeon			
	Surgeon 1	Surgeon 2	P
Age, median (IQR)	60.1 (56.4, 65.0)	57.8 (53.9, 64.2)	0.337
PSA, median (IQR)	6.2 (4.3, 7.3)	5.4 (2.9, 8.1)	0.385
Biopsy Gleason Sum, n (%)			
<7	12 (57.1)	13 (50.0)	0.281
7	6 (28.6)	12 (46.2)	
<7	3 (14.3)	1 (3.8)	
Pathological Tumor Stage, n (%)			
pT2	18 (72.0)	17 (70.8)	0.928
pT3/4	7 (28.0)	7 (29.2)	
Pathological Gleason Sum, n (%)			
<7	11 (44.0)	4 (16.7)	
7	9 (36.0)	17 (70.8)	
<7	5 (20.0)	3 (12.5)	
Perineural Invasion, n (%)			
No	4 (16.0)	2 (8.0)	0.384
Yes	21 (84.0)	23 (92.0)	
Prostate Weight (g), median (IQR)	45 (38.0, 55.0)	40.0 (35.0, 56.0)	0.226
Estimated Blood Loss, median (IQR)	200.0 (150.0, 350.0)	200.0 (125.0, 300.0)	0.621
Anastomosis Time, median (IQR)	25.0 (21.0, 28.0)	15.0 (12.0, 18.0)	<0.001
Console Time, median (IQR)	216.0 (198.0, 255.0)	176.0 (136.0, 221.0)	0.002

Table 2. Multivariate Analysis of Disease Risk Stratified by Surgeon				
	OR	Confidence Interval (95%)		P
		Lower	Upper	
Age, median (IQR)	0.97	0.87	1.07	0.501
PSA, median (IQR)	1.03	0.93	1.14	0.592
Pathological Tumor Stage (pT2 vs pT3 / 4)	0.68	0.10	4.38	0.682
Pathological Gleason Sum				
7	10.14	1.20	85.51	0.033
<7	2.34	0.12	43.63	0.570
Prostate Weight (g)	1.02	0.96	1.09	0.438
Perineural Invasion	5.20	0.32	85.10	0.247

Another potential advantage of posterior reconstruction of the rhabdosphincter is decreased time to continence following RARP.¹²⁻¹⁵ Early studies on the posterior recon-

struction by Rocco and colleagues^{12,13} evaluated patients who underwent RARP using their technique of posterior reconstruction prior to the anastomosis and compared these patients with a control group who underwent standard RARP without reconstruction. The authors suggest that incontinence after RARP is due to both anatomical and functional changes that occur when the prostate is removed. These changes include the urethral sphincter division as well as the discontinuity created in Denonvilliers' fascia, the dorsal fascia, and the central tendon of the perineum. Reconstruction of this discontinuity, mainly Denonvilliers fascia, reduced the time to continence in RARP patients by maintaining anatomical positioning as well as preserving functional length. Patients undergoing posterior reconstruction were quicker to regain continence based on assessments at 3-, 30-, and 90-day intervals. This recovery of continence was not dictated by age or progression of disease, but rather an independent finding based on the procedure.

An inherent learning curve exists when performing robotic surgery for both trained and novice surgeons, al-

though the extent of this learning curve is not well defined. Several studies^{16,17} suggest that the use of RARP leads to immediate improvement in surgical outcomes, while other studies suggest that a significant number of cases are needed before better results are seen.¹⁸⁻²⁰ Regardless of how many cases it takes to see an improvement over established surgical outcomes, the literature suggests that there is an initial learning curve associated with RARP, and that after a number of cases surgeons improve their robotic skills. Because of this, the addition of a technique that makes RARP simpler for surgeons in training is invaluable. Our results, which show that training surgeons have decreased anastomosis times, provides evidence that supports its use in all training for RARP cases.

A study by Atug et al⁸ analyzed the RARP surgical margin rate by dividing patients into groups based on surgical case number. The number of positive surgical margins decreased significantly with a higher case volume (45.4% and 11.7%, respectively). They concluded that 30 RARP cases are needed to gain proficiency with the robotic technique. Our study demonstrated that the anastomotic time in RARP might be reduced with the use of posterior reconstruction, thus reducing the anastomosis time. Incorporating posterior reconstruction into the RARP technique may reduce the number of surgeries for a surgeon to gain proficiency, and thus could positively affect other factors involved in the surgery, such as decreasing the number of positive surgical margins seen.

Even for experienced laparoscopic surgeons, the amount of time needed to learn RARP techniques has been estimated to be similar to that of a surgeon in training.¹⁹ Zorn et al⁶ evaluated the surgical outcomes of the first 150 RARPs performed by an experienced laparoscopic surgeon learning the robotic technique. They found that operative times in the first cases were significantly longer than operative times in cases performed later in the series. Our findings suggest that posterior reconstruction can shorten the anastomosis time by increasing the technical ease of anastomosis and play a role in decreasing total operative time. While our current findings looked at surgeons in training, we believe this can be extended to experienced surgeons learning the robotic technique.

This study has several limitations. Inherent variations exist in the technique and skill amongst surgeons in training. However, because both surgeons in this study trained through the same program and had very similar prior experience, we believe that these differences were kept to a minimum. Not all data points were available for each

patient. Each patient had an anastomosis time, but some were missing other factors, such as Gleason scores. We find it unlikely that this skewed that data, because very few scores were missing, but it nonetheless is a limitation that must be mentioned. We also did not include continence data in this cohort of patients. Further analysis is necessary to confirm whether the posterior reconstruction led to quicker return to continence in our patients.

CONCLUSION

The use of the posterior reconstruction technique during RARP shortens urethral anastomosis time for a surgeon in training. The posterior reconstruction may decrease the anastomotic time associated with RARP.

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